# IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of:

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| Applicants: | : | Mark Lucera et al. |
| Serial No. | : | 10-045,605 |
| Filing Date | : | January 11, 2002 |
| Title of Invention | : | MULTIPATH SCAN DATA SIGNAL PROCESSOR HAVING MULTIPLE SIGNAL PROCESSING PATHS WITH DIFFERENT OPERATIONAL CHARACTERISTICS TO ENABLE PROCESSING OF SIGNALS HAVING INCREASED DYNAMIC RANGE |
| Examiner | : | Thien Le |
| Group Art Unit | : | 2876 |
| Attorney Docket No. | : | 108-152USA000 |

Honorable Commissioner of Patents
and Trademarks
Washington, DC 20231

## INFORMATION DISCLOSURE STATEMENT
## UNDER 37 C.F.R. 1.97

Sir:

In order to fulfill Applicants' continuing obligation of candor and good faith as set forth in 37 C.F.R. 1.56, Applicants submit herewith an Information Disclosure Statement prepared in accordance with 37 C.F.R Sections 1.97, 1.98 and 1.99.



The disclosures enclosed herewith are as follows:

### U.S. PUBLICATIONS

| NUMBER | FILING DATE | TITLE |
|---|---|---|
| 6,047,894 | October 26, 1995 | SIGNAL CONDITIONING FOR VARIABLE FOCUS OPTICAL READER |
| 5,952,644 | March 17, 1997 | BAR CODE READER WITH MULTIPLE SENSITIVITY MODES USING VARIABLE THRESHOLDING COMPARISONS |
| 5,925,868 | August 28, 1997 | METHOD AND APPARATUS FOR DETERMINING TRANSITIONS BETWEEN RELATIVELY HIGH AND LOW LEVELS IN AN INPUT SIGNAL |

| | | |
|---|---|---|
| 5,923,023 | August 28, 1997 | METHOD AND APPARATUS FOR DETECTING TRANSITIONS IN AN INPUT SIGNAL |
| 5,869,827 | August 15, 1997 | MULTIPLE WINDOW SCANNER AND METHOD FOR MULTIPLE FOCAL DISTANCE READING |
| 5,545,888 | May 22, 1995 | DIGITIZER CIRCUIT FOR A BAR CODE READER |
| 5,463,211 | May 7, 1993 | METHOD AND APPARATUS FOR DETECTING TRANSITIONS IN A TIME SAMPLED INPUT SIGNAL |
| 5,371,361 | February 1, 1993 | OPTICAL PROCESSING SYSTEM |
| 5,347,121 | December 18, 1992 | VARIABLE FOCUS OPTICAL SYSTEM FOR DATA READING |
| 5,298,728 | November 1, 1991 | SIGNAL PROCESSING APPARATUS AND METHOD |
| 4,800,256 | December 8, 1986 | HALOGRAPHIC SCANNER HAVING ADJUSTABLE SAMPLING RATE |
| 4,798,943 | September 30, 1986 | METHOD AND SYSTEM FOR CONTROL OF A BAR CODE SCANNER THRESHOLD |
| 4,758,058 | January 12, 1987 | HOLOGRAPHIC DISK SCANNER HAVING SPECIAL POSITION-INDICATING HOLOGRAMS |
| 4,728,789 | December 8, 1986 | SYSTEM FOR ADJUSTING HOLOGRAPHIC SCANNER LOCKOUT VOLTAGE |
| 4,652,732 | September 17, 1985 | LOW-PROFILE BAR CODE SCANNER |
| 4,560,862 | April 26, 1983 | SYSTEM FOR OPTICAL SCANNING OVER A LARGE DEPTH OF FIELD |
| 4,548,463 | February 13, 1984 | HOLOGRAPHIC SCANNER CONTROL BASED ON MONITORED DIFFRACTION EFFICIENCY |

| | | |
|---|---|---|
| 4,000,397 | March 21, 1975 | SIGNAL PROCESSING METHOD AND APPARATUS |

## FOREIGN PUBLICATIONS

| NUMBER | PUBLICATION DATE | TITLE |
|---|---|---|
| GB 2 246 653 B | February 5, 1992 | METHOD OF OPERATING A BAR CODE SCANNER |

## STATEMENT OF PERTINENCE

U.S. Patent No. 6,047,894 to Arends et al., discloses in col. 3, lines 9-12, that a greater depth of field in scanners accentuates noise problems as higher frequencies are generated as a result of using smaller labels and reading labels at longer distances. U.S. Patent No. 6,047,894 also discloses apparatus for conditioning an input signal provided from an optical detector (e.g. bar code symbol scanner). As disclosed in Figs. 2a, 3a, 3b, 3c, 9a, 12, 14, 17 and 18, the apparatus includes signal conditioning circuitry with adjustable time delay elements and a controller for dynamically modifying the adjustable time delay elements in order to modify the frequency response characteristics of the signal conditioning circuitry. As disclosed, the apparatus determines the transitions between binary levels of an input signal such as a scanned bar code label by detecting zero crossings of an approximated second derivative of the input signal. Samples of the input signal are obtained by using delay lines, sample-and-hold circuits, an analog shift register or similar device. The first derivative of the signal is approximated by the slope of a straight line between two sampled points on the waveform. The second derivative is approximated by the difference between two first derivatives. Zero crossings of the second derivative indicating transitions of the input signal may be determined either by detecting a signal peak on both sides of the zero crossing, or by comparing the second derivative signal to zero when the first derivative exceeds a positive or negative threshold. The amount of shift in the zero crossings may be estimated by measuring relative amplitudes or widths of the surrounding signal lobes. The time between sample points may be adjusted to match a particular range setting of a scanner having a plurality of range settings. As disclosed in col. 25, lines 46-61 of U.S. Patent No. 6,047,894, the time delay period may be dynamically adjusted to enable the reading of labels of various sizes at various distances over a wide depth of field. The delay period may be chosen as one of several discrete periods or may be a continuously variable delay period. Further, the delay period may also be matched to a particular range setting of an adjustable-focus scanner such as described in U.S. Patent No. 5,347,121. A different delay period could be selected for each range or zone of operation. The low-pass filter could also be dynamically varied in conjunction with the time delay period in order to compensate for the different expected frequencies at different scanning ranges.

U.S. Patent No. 5,952,644 to Barkan discloses a bar code scanner having a multiple sensitivity-mode digitizer circuit that performs two thresholding techniques. The bar code reader includes a first derivative circuit for receiving an analog signal from a scan of the bar code symbol and for generating a first derivative signal of the analog signal. The digitizer circuit includes a first thresholding circuit for generating a first digitized signal in response to a comparison between the first derivative signal and a first threshold representing a first detection sensitivity. A second thresholding circuit generates a second digitized signal in response to a comparison between the first derivative signal and a second threshold representing a second detection sensitivity. A mode selector selects as the output digitized signal, either the first digitized signal or a third digitized signal representing the first digitized signal modified by the second digitized signal.

U.S. Patent No. 5,925,868 to Arends et al., discloses an apparatus for determining the transitions between binary levels of a scanned bar code label, as disclosed in U.S. Patent No. 6,047,894.

U.S. Patent No. 5,923,023 to Arends et al., discloses an apparatus for determining the transitions between binary levels of a scanned bar code label, as disclosed in U.S. Patent Nos. 5,925,868 and 6,047,894.

U.S. Patent No. 5,869,827 to Rando discloses a bioptical bar code reader, wherein sensors are provided to control the focal distance setting of the laser scanning pattern from each of the windows to enable reading at different focal distances in the scan volume.

U.S. Patent No. 5,545,888 to Barkan et al., discloses a circuit for digitizing an analog scan data signal generated during bar code scanning operations. As disclosed, the digitizing circuit includes a differentiator for differentiating the analog signal. An inverter inverts the differentiated signal to generate an inverted signal. A negative peak detector detects negative amplitude peaks and a positive peak detector detects positive amplitude peaks of the differentiated signal and generate, respectively, a negative and positive peak signal. Adders are used to add the positive peak signal to the inverted signal, and the negative peak signal to the inverted signal. A comparator compares the two summed signals to the differentiated signal and generates pulse signals indicative of the edges of the analog signal. A controller, in response to the pulse signals, generates a digital signal corresponding to the indicia being scanned.

U.S. Patent No. 5,463,211 to Arends et al., discloses an apparatus for determining the transitions between binary levels of a scanned bar code label, as disclosed in U.S. Patent No. 6,047,894.

U.S. Patent No. 5,371,361, to Arends et al., discloses a method of and apparatus for holding an otherwise variable parameter in a bar code scanner approximately constant over a desired scan volume to improve the ability to compensate for unwanted variations in the amplitude modulation depth of a signal, the signal being determined from collected light reflected from a target. In one embodiment, the time domain impulse response of the opto-mechanical system is the parameter which is held approximately constant by appropriately positioning the beam waist so that the beam spot size diverges approximately linearly along the beam axis within the scan

volume.

U.S. Patent No. 5,347,121 to Rudeen discloses an optical system and method for data reading wherein a light source generates an optical beam that directed toward an object to be read and a variable aperture mechanism is positioned in the outgoing light path to establish at least two separate focal planes. The variable aperture device may comprise a variable aperture system in which the size of the aperture is selectively varied about a range within the diffractive limit of the light beam. As disclosed, a preferred aperture mechanism is an LCD aperture with one or more aperture regions which are selectively or consecutively activated.

U.S. Patent No. 5,298,728 to Elliott et al., discloses a signal processing circuitry adapted for use in bar code scanners. The circuitry forms a derivative signal, and utilizes the derivative signal to detect transition points from white to black bars and vice-versa. Then, the circuitry starts and stops the generation of digital pulses at or about the transition points, thereby generating pulses having widths corresponding to the widths of the bars making up the bar code symbol.

U.S. Patent No. 4,800,256 to Broockman, et al. discloses a holographic laser scanning system for use in a laser printer, wherein the holographic scanning disc is provided with a data track for generating a signal indicating which holographic scanning facet is being used to generate a scanline, and for producing a sampling signal having a frequency related to the focal length of the identified facet in order to optimize light collection and detection operations.

U.S. Patent No. 4,798,943 to Cherry discloses a system for controlling a bar code scanner threshold with deliberate decay. As disclosed, the system includes circuitry for monitoring a selected scan signal characteristic or characteristics, and electronically determining whether sets of signal characteristics represent a bar code or extraneous noise, and, if noise is indicated, raising the black/white threshold until noise is no longer detected. The monitored characteristics can include frequency of perceived black/white transition. As disclosed, the raw scan signal is processed through two circuits. In the first circuit, a threshold is generated based on the signal and a selected threshold criterion. In the second circuit, the threshold generated in the first circuit is applied to the signal to produce a bar signal output, which output is then monitored by a noise recognition device. If noise is perceived by the noise recognition device, a threshold offset signal is generated. The threshold generated in the first circuit is raised by adding to it the threshold offset signal. Then the raised threshold is fed through a threshold detection device into a third circuit which also received the scan signal. The third circuit produces an output bar signal which substantially excludes noise readings. In this way, although the threshold will decay to accommodate changing conditions, it will be raised as necessary if it goes so low as to start reading noise.

U.S. Patent No. 4,758,058 to Cato, et al. discloses a holographic laser scanning system, wherein the holographic scanning disc is provided with position-indicating holograms which redirect the laser beam along desired paths on the same side of the scanning disc as the laser, for use in generating signals indicative of the current disc position signals.

U.S. Patent No. 4,728,789 to Broockman et al., discloses a fixed position optical scanner employing a multi-faceted holographic scanning disk. The scanner includes circuitry for adjusting the lockout voltage as a function of the focal length of the active scanning facet. The disk position

is tracked to identify the active scanning facet. A facet identifying signal is used to address a lockout table for processor memory. A digital value retrieved from the lockout table is converted to analog form and applied through a resistor to a voltage divider in the threshold circuit. The voltage divider scales down a white peak following voltage and compares it to a black peak following voltage. The facet-dependent lockout voltages biases the junction of the voltage divider to vary the effective lockout voltage as a function of the focal length of the currently active scanning facet.

U.S. Patent No. 4,652,732 to Nickl discloses an apparatus for scanning a bar code affixed to an object and providing an electrical signal indicative of the scanned bar code. The apparatus includes a housing having a base portion and a window portion with the window portion being mounted above a rear section of the base portion. A forward section of the base portion has a flat top surface while the window portion has an optically transmissive window mounted in a wide facing the top surface. The region above the top surface and adjacent the window defines a scanning region. Means are mounted within the housing for generating first, second and third scan patterns, each comprised of a plurality of substantially parallel spaced apart light scan lines. The first scan pattern scan lines each enter the scanning region through the window at planes each at a predetermined angle from planes parallel to the top surface. The third scan pattern scan lines each enter the scanning region through the window at planes each at a second predetermined angle from planes parallel to the top surface. The second scan pattern scan lines each enter the scanning region through the window at planes each substantially perpendicular to the plane of the top surface. The second scan pattern scan lines are oriented along the window for entering the scanning region between the first and second scan pattern scan lines. Means are included for detecting light reflected from the bar code affixed to an object being scanned within the scanning region back through the window. The means for detecting light detects the reflected light having at least a predetermined intensity and provides an electrical signal in response thereto. Means are included for directing the reflective light from a bar code affixed to an object within the scanning region to the means for detecting light.

U.S. Patent No. 4,560,862 to Eastman et al. discloses a system for optically scanning objects, particularly bar codes, over a large depth of field. As disclosed, the system uses an incandescent light source to illuminate the bar code, and scans the scanning field using a rotating polygon having mirrors with different curvature on different facets thereof which provides scanning in different focal planes in the field while temporally multiplexing these focal planes.

U.S. Patent 4,548,463 to Cato, et al. discloses a holographic laser scanning system, wherein certain operating parameters thereof (e.g. , video amplifier gain and/or semiconductor laser current) are adjusted on a real-time basis as a function of the actual diffraction efficiency of the facet region aligned with the incident laser beam. As disclosed, the zero order component of the beam is measured to determine the diffraction efficiency of each holographic facet.

U.S. Patent No. 4,000,397 to Hebert et al., discloses a method of and apparatus for processing input binary encoded analog signals to precisely determine the time occurrence of positive-going and negative-going signal level transitions. Such digital signals result, for example, when bar codes (e.g. Universal Product Codes) are optically scanned. Transitions are determined by detecting the zero crossings, at selected gating times, of the second derivative of the input

signals. The selected gating times occur whenever the first derivatives of the input signals exceed a threshold level. The threshold level is determined in one embodiment by peak-to-peak detecting the input signals and adding this value to a rectified noise measurement signal.

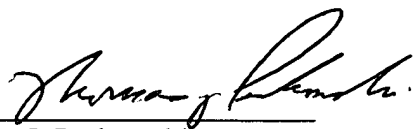
Published UK Patent Specification No. GB 2 246 653 B, to Metlitsky et al., discloses a hand-held bar code symbol scanner employing a scan data signal processor which widens its first derivative signal processing bandwidth when high density bar code symbols are being scanned, and narrows its first derivative symbol processing bandwidth when low density bar codes are being scanned.

A separate listing of the above references on PTO Form 1449 and a copy of these references are enclosed herewith for the convenience of the Examiner.

The Commissioner is authorized to charge the requisite fee of $180.00, as well as any fee deficiencies or overpayments to Deposit Account No. 16-1340. A copy of this page is enclosed herewith.

Respectfully submitted,

Dated: October 23, 2003



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**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**



| Sheet | 1 | of | 3 |
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| Complete If Known | |
|---|---|
| Application Number | 10/045,605 |
| Filing Date | January 11, 2002 |
| First Name Inventor | Mark Lucera et al. |
| Group Art Unit | 2876 |
| Examiner Name | Thien Le |
| Attorney Docket Number | 108-0152USA000 |

**U.S. PATENT DOCUMENTS**

| Examiner Initials | Cite No. | U.S. Patent Documents | | Name of Patentee or Applicant of Cited Document | Date of Publication of Cited Document MM-DD-YYYY | Intn'l Class / Sub Class |
|---|---|---|---|---|---|---|
| | | Number | Kind Code (if known) | | | |
| | | 6,047,894 | | Arends et al. | 04/11/2000 | G06K 7/10 |
| | | 5,952,644 | | Barkan | 09/14/1999 | G06K 7/10 |
| | | 5,925,868 | | Arends et al. | 07/20/1999 | G06K 7/10 |
| | | 5,923,023 | | Arends et al. | 07/13/1999 | G06K 7/10 |
| | | 5,869,827 | | Rando | 02/09/1999 | G06K 7/10 |
| | | 5,545,888 | | Barkan et al. | 08/13/1996 | G06K 7/10 |
| | | 5,463,211 | | Arends et al. | 10/31/1995 | G06K 7/10 |
| | | 5,371,361 | | Arends et al. | 12/06/1994 | H01V 3/14 |
| | | 5,347,121 | | Rudeen | 09/13/1994 | G06K 7/10 |
| | | 5,298,728 | | Elliott et al. | 03/29/1994 | G06K 7/10 |
| | | 4,800,256 | | Brookkman et al. | 01/24/1989 | G06K 7/10 |

## U.S. PATENT DOCUMENTS

| Examiner Initials | Cite No. | U.S. Patent Documents | | Name of Patentee or Applicant of Cited Document | Date of Publication of Cited Document MM-DD-YYYY | Intn'l Class / Sub Class |
|---|---|---|---|---|---|---|
| | | Number | Kind Code (if known) | | | |
| | | 4,798,943 | | Cherry | 01/17/1989 | G06K 7/10 |
| | | 4,758,058 | | Cato et al. | 07/19/1988 | G02B 26/10 |
| | | 4,728,789 | | Broockman et al. | 03/01/1988 | G02B 5/32 |
| | | 4,652,732 | | Nickl | 03/24/1987 | G06K 7/10 |
| | | 4,560,862 | | Eastman et al. | 12/24/1985 | G06K 7/10 |
| | | 4,548,463 | | Cato et al. | 10/22/1985 | G02B 5/32 |
| | | 4,000,397 | | Hebert et al. | 12/28/1976 | G06K 7/10 |

| FOREIGN PATENT DOCUMENTS | | | | | | | | |
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| Examiner Initials | | Foreign Patent Document | | | Name of Patentee or Applicant of Cited Document | Date of Publication of Cited Document MM-DD-YYYY | Intn'l Class / Sub Class | T * |
| | | Numbe r | Kind Code (if known) | | | | | |
| | | GB | GB 2 246 653 B | | Symbol Technologies, Inc., Bohemia NY | 02/05/1992 | | |

**EXAMINER** **DATE CONSIDERED**

**EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance not considered. Include copy of this form with next communication to applicant.**

**(INFORMATION DISCLOSURE STATEMENT – SECTION 9 PTO-1449)**